Transmission and Storage Sector

September 14, 2012

*This presentation contains minor corrections to slides presented at the workshop.*
Transmission and Storage Sector

- 43.8 MMT CO$_2$e
- 20.3% of total natural gas systems emissions

2010 Methane Emissions from Natural Gas Systems (MMT CO$_2$e)

- Production: 126.0
- Processing: 28.5
- Transmission and Storage: 43.8
- Distribution: 17.1
Background

Transmission and Storage Sector – Sources associated with natural gas transmission, underground storage, liquefied natural gas (LNG) storage, and LNG import and export.

2012 Inventory Transmission and Storage Emissions (MMT CO$_2$e)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Calculated Potential</td>
<td>49.2</td>
<td>51.3</td>
<td>52.1</td>
<td>51.9</td>
<td>53.0</td>
</tr>
<tr>
<td>Voluntary Reductions</td>
<td>0.0</td>
<td>-(2.5)</td>
<td>-(5.4)</td>
<td>-(10.5)</td>
<td>-(9.2)</td>
</tr>
<tr>
<td>Regulatory Reductions</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Net Emissions</td>
<td>49.2</td>
<td>48.7</td>
<td>46.7</td>
<td>41.4</td>
<td>43.8</td>
</tr>
</tbody>
</table>
# Transmission and Storage Emission Sources

<table>
<thead>
<tr>
<th>Transmission Sources</th>
<th>Storage Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNG (details in slides)</td>
<td>Dehydrator vents (Transmission)</td>
</tr>
<tr>
<td>Pipeline Leaks</td>
<td>Dehydrator vents (Storage)</td>
</tr>
<tr>
<td>Station (transmission)</td>
<td>Engines (Transmission)</td>
</tr>
<tr>
<td>Recip Compressor (transmission)</td>
<td>Turbines (Transmission)</td>
</tr>
<tr>
<td>Centrifugal Compressor (wet seals) (transmission)</td>
<td>Engines (Storage)</td>
</tr>
<tr>
<td>Centrifugal Compressor (dry seals) (transmission)</td>
<td>Turbines (Storage)</td>
</tr>
<tr>
<td>Station (storage)</td>
<td>Generators (Engines)</td>
</tr>
<tr>
<td>Recip Compressor (storage)</td>
<td>Generators (Turbines)</td>
</tr>
<tr>
<td>Centrifugal Compressor (wet seals) (storage)</td>
<td>Pneumatic Devices Trans</td>
</tr>
<tr>
<td>Centrifugal Compressor (dry seals) (storage)</td>
<td>Pneumatic Devices Storage</td>
</tr>
<tr>
<td>Wells (Storage)</td>
<td>Pipeline venting</td>
</tr>
<tr>
<td>M&amp;R (Trans. Co. Interconnect)</td>
<td>Station Venting Transmission</td>
</tr>
<tr>
<td>M&amp;R (Farm Taps + Direct Sales)</td>
<td>Station Venting Storage</td>
</tr>
</tbody>
</table>
Top Transmission and Storage Emission Sources

2010 Methane Emissions (2012 Inventory), MMTCO$_2$e

- Reciprocating Compressors (transmission) - 15.7
- Centrifugal Compressors (wet seals) (transmission) - 12.8
- Engines (transmission) - 5.0
- Reciprocating Compressors (storage) - 3.7
- Total LNG - 4.7
- Other - 1.9
Top Transmission and Storage Emissions Sources

- **Reciprocating compressors (transmission):** fugitive and vented emissions from reciprocating compressor related equipment at transmission compressor stations.
  - 12.8 MMT CO$_2$e, or 29.2% of Transmission and Storage emissions
- **Centrifugal compressors (wet seals) (transmission):** fugitive and vented emissions from centrifugal compressor related equipment with wet seals at transmission compressor stations.
  - 5.0 MMT CO$_2$e, or 11.4% of Transmission and Storage emissions
- **Compressor engines (transmission):** methane emissions result from the incomplete combustion of the natural gas which allows some of the methane in the fuel to exit in the exhaust stream.
  - 4.7 MMT CO$_2$e, or 10.7% of Transmission and Storage emissions
- **Reciprocating compressors (storage):** fugitive and vented emissions from reciprocating compressor related equipment at storage compressor stations.
  - 3.7 MMT CO$_2$e, or 8.4% of Transmission and Storage emissions
- **Liquefied Natural Gas (LNG) (details on the following slide)**
  - 1.9 MMT CO$_2$e, or 4.3% of Transmission and Storage emissions
LNG

- Emissions from LNG Import/Export Terminals and Storage are 1.9 MMT CO$_2$e
  - LNG Import/Export Terminals 0.4 MMT CO$_2$e
  - LNG Storage 1.5 MMT CO$_2$e
- Sources include (for both Terminals and Storage)
  - Station Fugitives (0.2 MMT CO$_2$e)
  - Station venting (0.1 MMT CO$_2$e)
  - LNG Compressor Exhaust (Turbines) (<0.1 MMT CO$_2$e)
  - Reciprocating Compressors (1.0 MMT CO$_2$e)
  - Centrifugal Compressors (0.3 MMT CO$_2$e)
  - LNG Compressor Exhaust (Engines) (0.2 MMT CO$_2$e)
Calculating Net Emissions Transmission and Storage

- Voluntary reduction activities include:
  - Use of turbines at compressor stations
  - Replace wet compressor seals with dry seals
  - Use composite wrap repair
  - Use hot taps for in-service pipeline connections
  - Reduce/downgrade system pressure
  - Directed inspection and maintenance at compressor stations
  - Install vapor recovery units on pipeline liquid/condensate tanks

- No current regulatory activities identified

2010 Emissions from Transmission and Storage (2012 Inventory), MMT CO$_2$e

<table>
<thead>
<tr>
<th>Potential Methane</th>
<th>Voluntary Reductions</th>
<th>Regulatory Reductions</th>
<th>Emissions (MMT CO$_2$e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>53.0</td>
<td>- 9.2</td>
<td>N/A</td>
<td>= 43.8</td>
</tr>
</tbody>
</table>
Questions for Stakeholders

• Are more recent data sources available?
  – Activity data
  – Emission factors

• Suggestions for updates to presentation of transmission and storage sector information in the GHG Inventory?